

Translation

539,254

PATENT COOPERATION TREATY

PCT/JP2003/016007



PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 50308640	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/JP2003/016007	International filing date (day/month/year) 12 December 2003 (12.12.2003)	Priority date (day/month/year) 16 December 2002 (16.12.2002)
International Patent Classification (IPC) or national classification and IPC H05H 1/46, H01L 21/3065, 21/205, C23C 14/54		
Applicant JAPAN SCIENCE AND TECHNOLOGY AGENCY		

- This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 4 sheets, including this cover sheet.
- This report is also accompanied by ANNEXES, comprising:
  - ☒ (sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:
    - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
    - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
  - ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

- This report contains indications relating to the following items:

- ☒ Box No. I Basis of the report
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 20 July 2004 (20.07.2004)	Date of completion of this report 01 April 2005 (01.04.2005)
Name and mailing address of the IPEA/JP	Authorized officer
Facsimile No.	Telephone No.

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

national application No.

PCT/JP2003/016007

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on translations from the original language into the following language \_\_\_\_\_, which is language of a translation furnished for the purpose of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☐ The international application as originally filed/furnished
- ☒ the description:
- pages \_\_\_\_\_ 1-22 \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the claims:
- pages \_\_\_\_\_ 5-7, 9, 10, 12, 16-23, 28, 30, 31, 33, 35-37 \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_, as amended (together with any statement) under Article 19
- pages\* \_\_\_\_\_ 4, 24, 25 \_\_\_\_\_ received by this Authority on 20 July 2004 (20.07.2004)
- pages\* \_\_\_\_\_ 3, 8, 11, 13, 14, 26, 27, 29, 32, 34, 38 \_\_\_\_\_ received by this Authority on 17 February 2005 (17.02.2005)
- ☒ the drawings:
- pages \_\_\_\_\_ 1-24 \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☒ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☒ the claims, Nos. \_\_\_\_\_ 1, 2, 15 \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

**Box No. V** Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims	4-14, 16-22, 25, 27-35	YES
	Claims	3, 23, 24, 26, 36, 37, 28	NO
Inventive step (IS)	Claims	8-10, 29-31	YES
	Claims	3-7, 11-14, 16-28, 32-38	NO
Industrial applicability (IA)	Claims	3-14, 16-38	YES
	Claims		NO

## 2. Citations and explanations (Rule 70.7)

Claims 3, 23, 24, 26 and 36-38

Document 1: JP, 2001-35697, A (Japan Science and Technology Corp., presently named Japan Science and Technology Agency), 9 February, 2001 (09.02.01), paragraphs 0008-0039 and 0047-0050, Figs. 1, 3 and 9-11

Document 1 describes an inductively coupled plasma processing technique using a high frequency power, in which an antenna radiating a high frequency power is disposed without being circled in a vacuum vessel, with the length of the said antenna kept shorter than  $1/4$  of the wavelength of the said high frequency. The document also describes that in the case where plural antennas are disposed in parallel, the adjacent electrodes of adjacent antennas are kept identical in polarity. (Fig. 11 shows three or more U-shaped planar antennas disposed in a vacuum vessel. Furthermore, from the description of paragraph 38 and Fig. 9, a ring electrode has a diameter of 360 mm and the frequency is 13.56 MHz. So, by calculation, the ring electrode as an antenna (half length) has a length of  $\lambda/4$  or less.)

Therefore, the subject matters of claims 3, 23, 24, 26 and 36-38 do not appear to be novel in view of document 1.

Claims 3-7, 11-14, 16-28 and 32-38

Document 2: JP, 2000-3878, A (Mitsubishi Heavy Industries, Ltd.), 7 January, 2000 (07.01.00), paragraphs 0057-0063, Fig. 1

Document 3: JP, 8-8096, A (The BOC Group, Inc.), 12 January, 1996 (12.01.96), paragraph 0028

Document 4: JP, 8-325759, A (Anelva Corp.), 10 December, 1996 (10.12.96), paragraphs 0007-0009, 0034, 0035 and 0041, Figs. 1-3

Document 5: JP, 2000-73174, A (Mitsubishi Heavy Industries, Ltd.), 7 March, 2000 (07.03.00), paragraph 0019, Fig. 2

Document 6: JP, 2001-274099, A (Mitsubishi Heavy Industries, Ltd.), 5 October, 2001 (05.10.01), full text, all drawings

Document 7: JP, 11-233289, A (President of Nagoya University), 27 August, 1999 (27.08.99), paragraphs 0017-0040, Figs. 1-8

Document 8: JP, 2002-260899, A (Nihon Koshuha Co., Ltd.), 13 September, 2002 (13.09.02), full text, all drawings

Document 9: JP, 2000-331993, A (Mitsubishi Electric Corp.), 30 November, 2000 (30.11.00), full text, all drawings

Document 10: WO, 00-079568, A (Applied Materials Inc.), 28 December, 2000 (28.12.00), full text, all drawings

## Supplemental Box

In case the space in any of the preceding boxes is not sufficient.  
Continuation of: V

In addition to the above description, document 1 describes a technique in which an antenna is arranged virtually in parallel to a substrate base (Fig. 1), a technique in which the adjacent electrodes of two antennas are kept identical in polarity (Fig. 3) and a technique in which plural antennas are divided into three groups (Fig. 11).

Document 2 describes a technique in which the positions and number of feeding points on a ladder electrode are adjusted for keeping the voltage distribution on the said electrode sufficiently small.

Document 3 describes a multiple electrode plasma reactor power splitter technique, in which an equilibrium power is supplied to plural powered electrodes.

Document 4 describes a technique for suppressing the generation of standing waves in the supply route of a high frequency power as far as possible, in which (1) the intervals between electrodes or branched waveguides are adjusted or (2) a high frequency power is supplied in different phases to respective branched waveguides.

Document 5 describes a technique in which when a high frequency power is supplied to plural conductive rods in a vacuum vessel, it is fed through a common metallic frame.

Document 6 describes a technique in which respectively different high frequency powers are supplied from plural high frequency power supplies to ladder electrodes composed of plural rod antennas.

Document 7 describes a technique in which when a high frequency power is supplied to an antenna disposed in a vacuum vessel, it is supplied through a variable capacitor. The variable capacitor can be used to change the impedance value.

So, in a plasma processing technique using high frequency antennas, a technique in which the voltage or current supplied to the high frequency antennas or the value of their product is measured, to control the impedance value based on the measured value is well known without the necessity of showing any example. The particular measuring technique in the invention of the present application is commonly used art for a person skilled in the art.

Therefore, a person skilled in the art could have easily combined the techniques described in documents 1-7 and the said well-known and commonly used techniques, to arrive at the constitution in the subject matters of claims 3-7, 11-14, 16-28 and 32-38. In this case, a person skilled in the art could have, as required, used a variable inductance coil as an impedance element.

Meanwhile, techniques for independently controlling the high frequency powers or the like supplied to individual antennas are described in documents 8-10.

Therefore, the subject matters of claims 3-7, 11-14, 16-28 and 32-38 do not appear to involve an inventive step in view of documents 1-10.

#### Claims 8-10 and 29-31

Documents 1-10 neither describe nor suggest the constitution in which "the aspect ratio of an antenna is set at a value corresponding to the intended plasma density or plasma electron energy in the said intended area." This constitution is not considered to be obvious to a person skilled in the art either. Therefore, the subject matters of claims 8-10 and 29-31 appear to be novel and to involve an inventive step.